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THE RESISTIVITY OF AQUEOUS SOLUTIONS OF SODIUM CHLORIDE

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UNITED STATES NAVAL ORDNANCE LABORATORY, WHITE OAK, MARYLAND

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THE RESISTIVITY OF AQUEOUS SOLUTIONS OF SODIUM CHLORIDE

by:

Martin B. Kraichman

ABSTRACT: Resistivity measurements were made of various aqueous solutions of sodium chloride using a calibrated conductivity cell with silver-silver chloride electrodes. Results in the form of curves are presented for salt concentrations from 1 to 26% in the temperature range from 5°C to 30°C.

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Physics Research Department
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WHITE OAK, MARYLAND

The work reported herein was done in 1954 in the Electricity and Magnetism Division, Physics Research Department and is intended for information only.

The author wishes to acknowledge the collaboration of S. P. Haddad, who was a member of the Electricity and Magnetism Division at that time.

R. E. ODENING
Captain, USN
Commander

Z. I. SLAWSKY
By direction

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THE RESISTIVITY OF AQUEOUS SOLUTIONS OF SODIUM CHLORIDE

Purpose

Whereas the resistivity of weak aqueous solutions of sodium chloride are readily available in many physical and chemical tables, the values of the resistivity of concentrated solutions as a function of temperature and percentage salt are not easily found. It is the purpose of this report to supply such information for various sodium chloride concentrations ranging from 1% to the saturation value of 26% in the temperature range from 5°C to 30°C. While only engineering accuracy is claimed for these results, they should be sufficiently good for many purposes such as the modeling of dissipative media for electromagnetic studies.

Measurement Procedure

The resistivity measurements were made using chemically pure, aqueous solutions of sodium chloride and a calibrated conductivity cell with silver-silver chloride electrodes. Figure 1 shows the construction of the cell. The outside diameter of the cell is about 3 inches and the length is about 22 inches. The silver-silver chloride disc electrodes are 2-1/2 inches in diameter and are separated by approximately 10 inches.

Before each measurement, the cell was carefully flushed by repeated immersion in the solution to be measured so as to remove any previous solution from between the electrodes. The resistance of the cell was then measured with a Wheatstone bridge. The measurement was repeated with the polarity of the cell reversed, and an average of the two readings was taken.

Results

The resistivity ρ in ohm-cm. was calculated from the formula

$$\rho = 0.69\ (R_m - 0.32),$$

in which R_m is the measured value of the cell resistance in ohms, the factor 0.69 represents the cell constant in centimeters and the quantity 0.32 is the resistance of the lead wires in ohms.

The results are presented in Figures 2, 3, and 4 in which the experimental points are indicated by small circles.

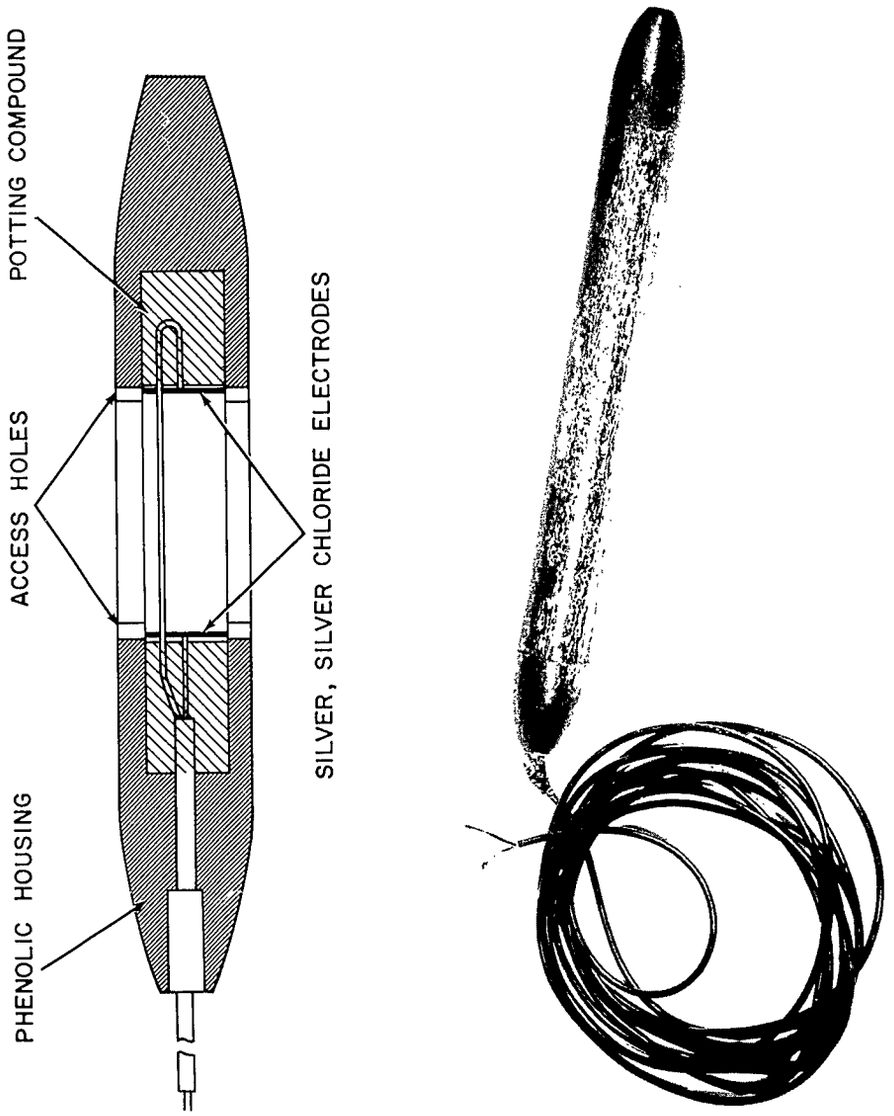

FIG. 1 CONDUCTIVITY CELL

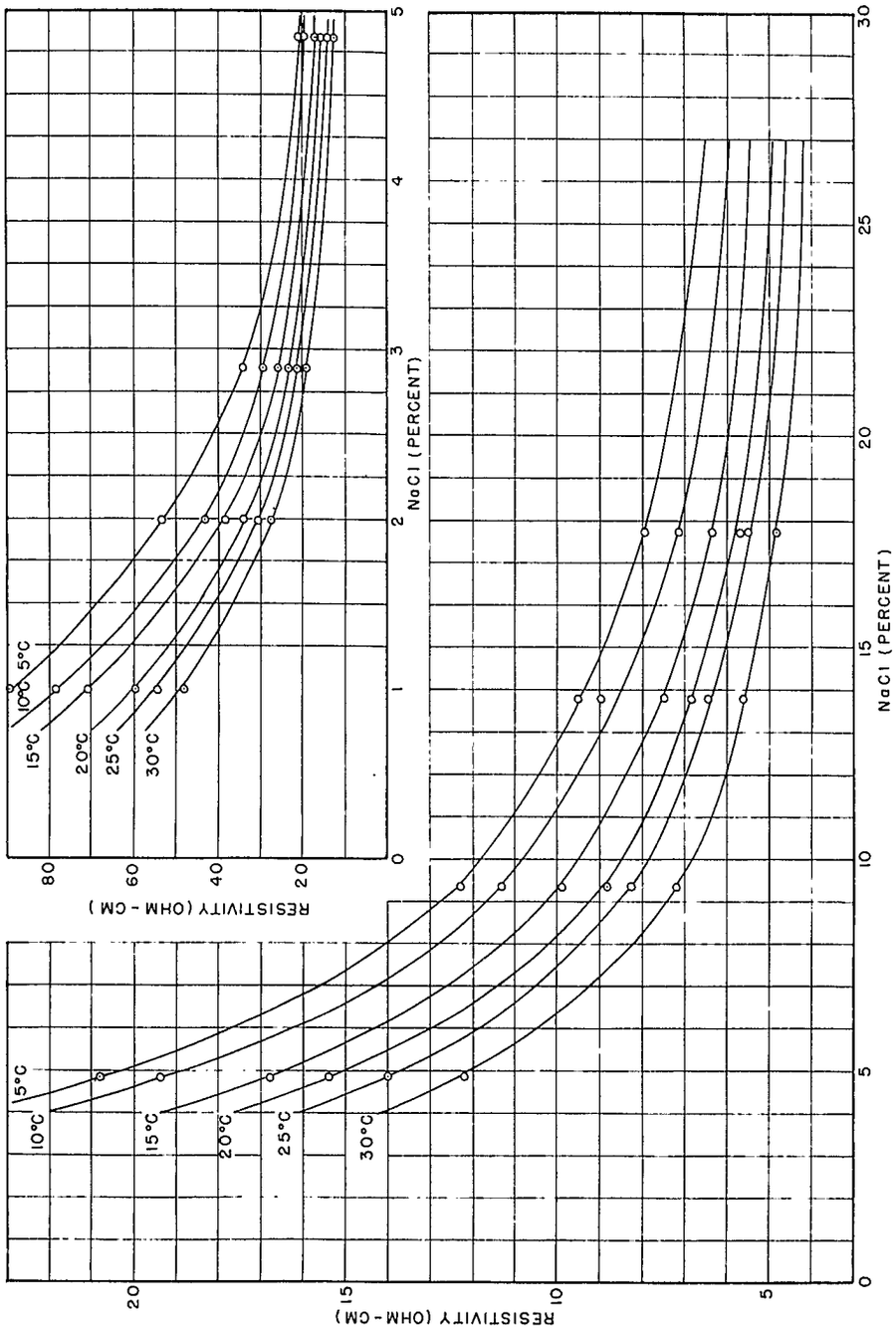

FIG. 2 RESISTIVITY VS PERCENT NaCl

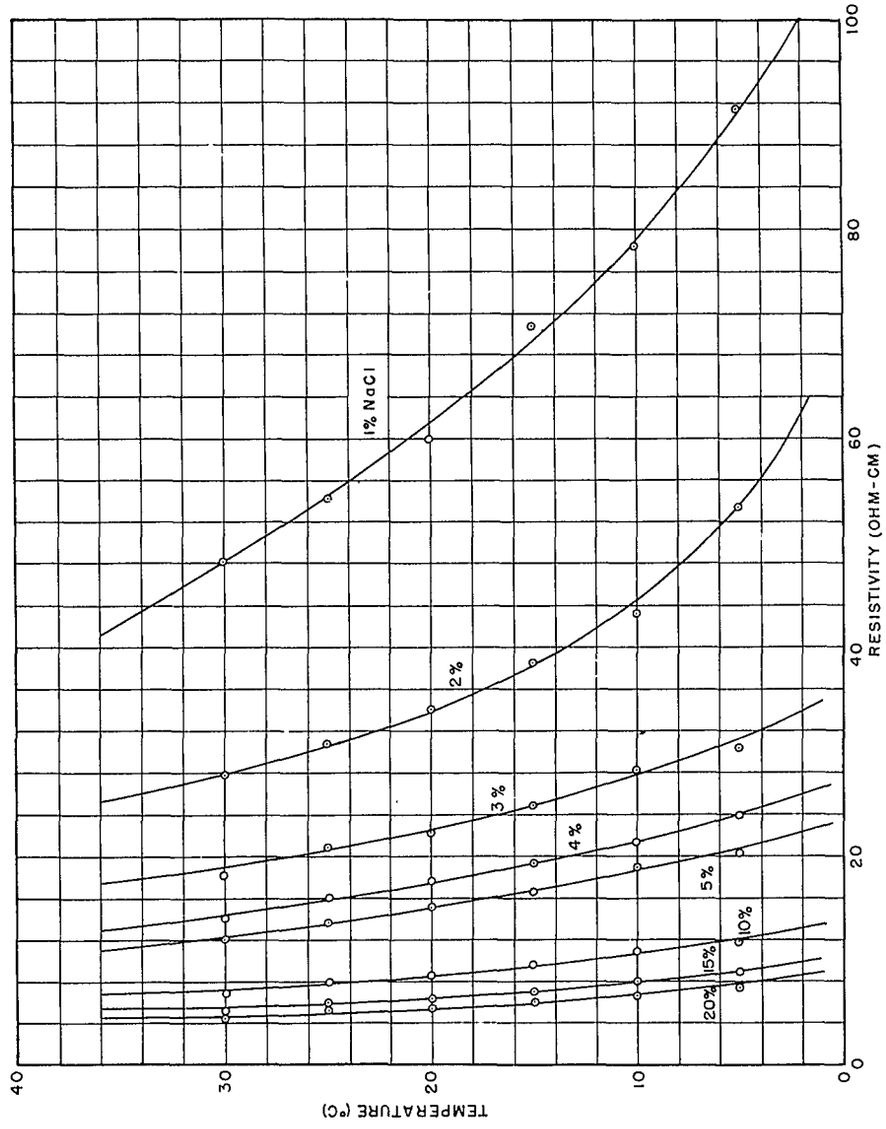

FIG. 3 TEMPERATURE VS RESISTIVITY

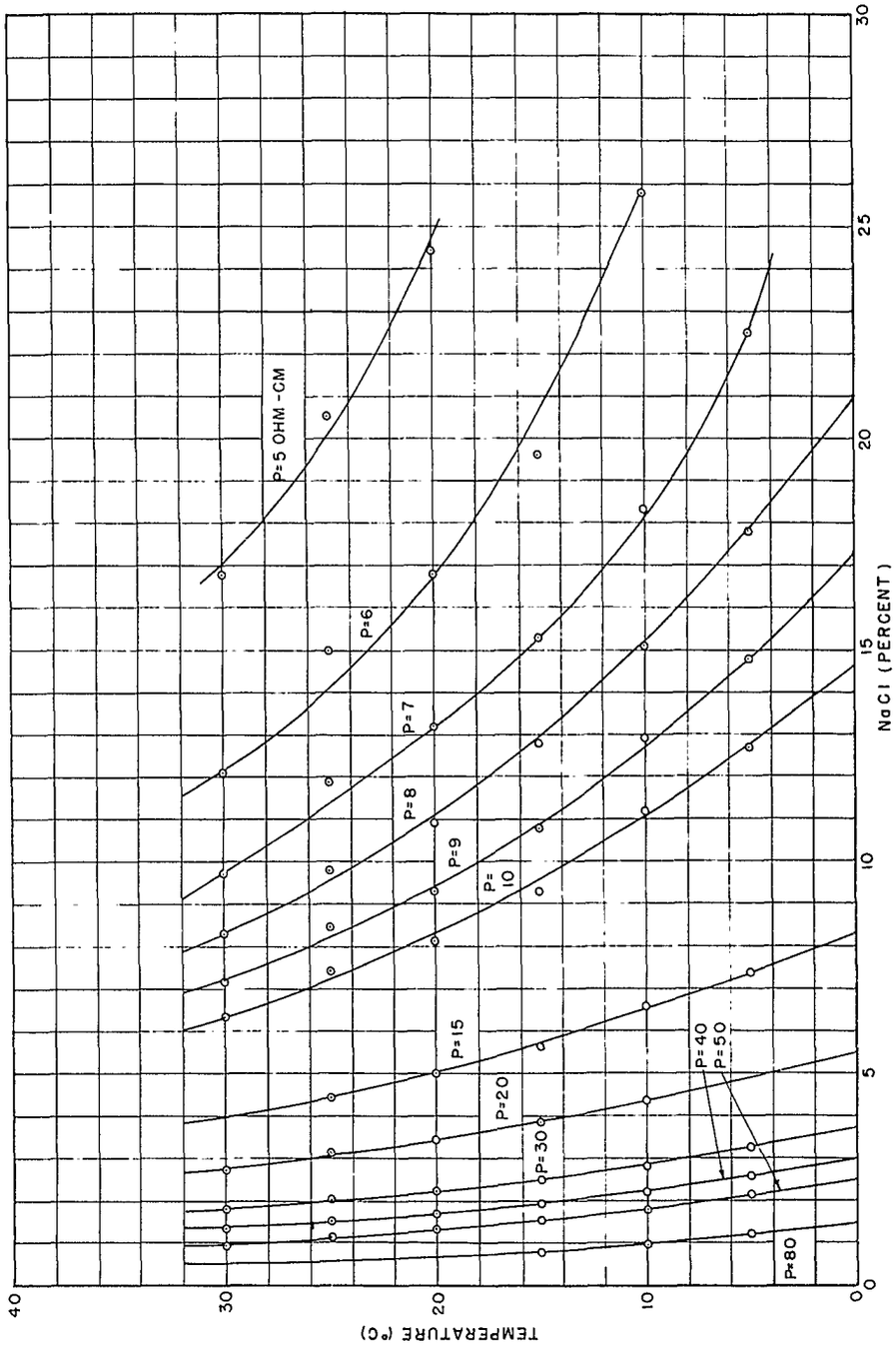

FIG. 4 TEMPERATURE VS PERCENT Na Cl

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SUBJECT ANALYSIS OF REPORT

DESCRIPTORS	CODES	DESCRIPTORS	CODES	DESCRIPTORS	CODES
Resistivity	REST	Curves	CURV		
Sodium	SODI	Salt	SALT		
Chloride	CHLO	Concentrations	CNCT		
Aqueous	WATR	Temperature	TEMP		
Solution	SOLT	Percentages	PRCN		
Measurement	MEAU	Variation	VART		
Calibrated	CALB				
Conductivity	COND				
Cell	CELL				
Silver	SILV				
Zinc	ZINC				
Electrodes	ELED				

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2. Sodium chloride - Conductivity
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II. Kraichman, Martin B.

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